The Business Aspects of Silviculture in the Delivery of Forest Products: A Panel Discussion

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ABSTRACT.—Use of designation by prescription (DxP) as a valid method to designate National Forest System timber for harvest is a significant change to the way the USDA Forest Service prepares and sells timber. Prior to the use of DxP, the Forest Service often used the expensive and time-consuming practice of the Forest Service marking individual trees to leave or cut with paint to ensure retention of the most desirable trees needed to meet management objectives. With DxP, a Forest Service silviculturist prepares a prescription describing the desired characteristics of the trees and stand to be retained following harvesting (i.e., desired end results). Using the prescription as a guide, the timber sale purchaser or stewardship contractor selects the trees to cut. Eliminating the need to mark trees in advance of cutting reduces sale preparation time and costs. Sale administration responsibilities and costs can increase, however, due to a lack of paint marks that aid the Forest Service's ability to quickly determine whether the correct trees were cut. Perspectives on the use of DxP, to date, and criteria for success are discussed by the panel.

INTRODUCTION

In the Agricultural Act of 2014, P.L. 113-79, Title VIII, Subtitle D, section 8303 (2014 Farm Bill), Congress authorized a significant change in USDA Forest Service business practices. The 2014 Farm Bill, among other things, specifically amended paragraph 14g of the National Forest Management Act of 1976 (16 U.S.C. 472a(g) (NFMA), to authorize the use of designation by prescription (DxP) as a valid method of designating timber to be harvested. The changes in the 2014 Farm Bill allow a prescriptive approach to describing desired stand conditions in a timber sale without needing to individually designate trees by marking them with paint to leave or cut. When DxP is used, a silvicultural prescription, prepared by a Forest Service silviculturist, specifies desired stand conditions. The timber sale purchaser or stewardship contractor has discretion, consistent with the prescription guidelines, to select the trees to cut. The 2014 Farm Bill authorized the Forest Service to supervise a purchaser's or contractor's choices during sale administration or later (16 U.S.C. 472a(g)(3)).

DxP may simplify sale preparation and reduce Forest Service sale layout costs for marking and may result in improved operational efficiency for some timber operators by providing more flexibility to choose which trees to select for removal based on the identified prescription, which is incorporated into contract special provisions. (Marking costs average approximately $70/acre according to cost studies conducted on the Four Forest Restoration Initiative [personal communication, Richard Fleishman, Coconino National Forest, May 2018].) But DxP may not always be the most appropriate tool. For example, some operators may not have the ability or technology to implement complex silvicultural prescriptions. This may

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prevent those operators from bidding, or it may increase their operational costs. Additionally, determining compliance with a prescription can be more time consuming for Forest Service sale administrators, who are unable to quickly look for the presence or absence of Forest Service paint marks on stumps. Further, the risk when trees are individually marked with paint prior to cutting and less discretion is given to a purchaser or contractor to choose which trees to cut, the risk that harvesting will meet desired conditions is lessened. Conversely, as the complexity of the prescription increases the risk of not meeting the prescription increases when using DxP due to more difficult on-the-ground interpretation.

DESIGNATION BY PRESCRIPTION BACKGROUND AND DEFINITIONS

Prior to the 2014 Farm Bill amendments, paragraph 14(g) of NFMA stated, "Designating, marking when necessary, and supervision of harvesting of trees, portions of trees or forest products shall be conducted by persons employed by the Secretary of Agriculture." As such, timber marking had to be conducted by Forest Service employees or by contractors who did not have a personal interest in the purchase or harvest of the timber and were not employed directly or indirectly by the purchaser of the timber.

Beginning as a pilot program in FY1999, the Stewardship Contracting Authority, 16 U.S.C. 6591c(d)(5), exempted stewardship contracts and agreements from paragraph 14(g) of NFMA. Under the exemption, persons other than those employed by the Secretary of Agriculture may designate trees to leave, or to be cut and removed, to meet restoration objectives. After enactment of the stewardship authority, the exemption prompted the Forest Service to adopt special DxP contract provisions for limited use on thinning sales in 2004. Under procedures developed by the FS, timber sale purchasers and stewardship contractors were often required to mark leave trees for FS approval prior to cutting.

Section 8303 of the 2014 Farm Bill, entitled "Extension of Stewardship Contracts Authority Regarding Use of Designation by Prescription to All Thinning Sales Under National Forest Management Act of 1976," amended paragraph 14(g) of NFMA as follows:

> (1) IN GENERAL
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> Designation, including marking when necessary, designation by description, or designation by prescription, and supervision of harvesting of trees, portions of trees, or forest products shall be conducted by persons employed by the Secretary of Agriculture.
>
> (2) REQUIREMENT Persons employed by the Secretary of Agriculture under paragraph (1)—
>
> (A) shall have no personal interest in the purchase or harvest of the products; and
>
> (B) shall not be directly or indirectly in the employment of the purchaser of the products.
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> (3) METHODS OF DESIGNATION
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> Designation by prescription and designation by description shall be considered valid methods for designation and may be supervised by use of postharvest cruise, sample weight scaling, or other methods determined by the Secretary of Agriculture to be appropriate.

Despite the reference to "thinning sales," the title of section 8303 does not have the force and effect of law. Consequently, section 8303 does not limit the use of DxP solely to thinning sales and is therefore applicable to all timber sales and stewardship contracts, and a broad range of silvicultural treatments. Under section 8303, preparation of the prescription, and supervision of the harvesting activities, must be performed by persons employed by the Secretary of Agriculture. Selection of which trees to cut, consistent with the prescription, may be left to the discretion of the timber sale purchaser or stewardship contractor.

Designation by description (DxD) and paint marking had been standard methods of designating timber in contracts for decades, but when the 2014 Farm Bill clearly authorized DxP as a valid method of designating National Forest System timber for harvest, the Forest Service significantly increased its use of DxP. New DxP contract provisions and implementation direction was issued in FSM 2440 in 2015. Implementation procedures and guidelines continue to evolve as use and experience with DxP increases. Recognizing efficiencies in sale layout, the Forest Service encouraged increased use of DxP in the Forest Products Modernization initiative through an internal letter from the Chief to the field in February 2018. The Forest Service is considering a policy that will allow timber sale purchasers and stewardship contractors to mark timber in advance of cutting, if they so choose, but the policy will not require them to do so.

In some DxP units, the Forest Service may choose to mark certain trees to be cut or left that don't fit into the general parameters of the prescription. For example, important wildlife trees might be marked to leave (called DxP with Reserve Tree Marking), while individual trees that the Forest Service specifically wants removed might be marked to cut. Because the trees harvested will differ from those that are measured when a DxP unit is cruised, Forest Service policy states that DxP is only authorized for use on timber sales and stewardship contracts where the volume for payment is measured by postharvest scaling.

Designation Definitions

Designation by Description (DxD). Trees are designated to be cut by describing measurable characteristics of individual trees and/or their juxtaposition to each other. Examples of descriptions include spacing, species, diameter, damage class, or a combination of two of these factors. Determining whether the correct trees are cut is done at the individual tree level. When trees are designated by the description, it is possible to look at individual stumps to determine if a tree was authorized to be cut or not.

Designation by Prescription (DxP). Trees are designated by describing the desired condition of the residual stand following harvest. The purchaser has discretion within the guidelines of the prescription, as described in the contract provisions, in selecting which trees to cut and which trees to leave. Determining whether the correct trees are cut or left is done at the cutting unit level. Examples include verifying whether a certain residual BA was left in the unit or measuring crown closure throughout the stand. Simple examples of criteria used in a DxP prescription include "leave 50 to 70 sq. ft. of basal area" in a southern yellow pine stand, or "leave two crowns touching" throughout an even-aged mixed conifer stand.

Designation by Marking. Trees are "marked" when individually designated with paint marks above and below stump height. Trees can be marked to cut or leave as distinguished by the color of paint used.

DISCUSSION ON APPLICATION OF DxP

This paper offers four perspectives on the use of DxP: three are from different FS Regions and one is from private industry. The perspectives focus on the successes and lessons learned when DxP is used to designate timber for harvesting.

Region 8—Jeff High

DxP on the Ouachita National Forest is used for a specific purpose: to deal with overstocked pine plantations. Historically, the Forest Service delayed entry into these stands until the trees were large enough to be marked at a sufficient spacing to facilitate mechanical logging equipment access. This delay has resulted in a backlog of overstocked stands with increased tree mortality that are susceptible to insect damage (e.g., stand-replacing southern pine beetle outbreaks). Using DxP, pine plantations can now be thinned at a younger age before serious forest health issues arise. For example, with DxP, the operator can plan access of machinery and vary tree to tree spacing to achieve both basal area prescription and logging equipment access. Timber markers would have difficulty doing this without significant logging experience and extensive layout considerations. The net result on a marked sale is that in sale administration, many of the marked "leave trees" must be marked to cut so the unit can be logged. In a "cut tree mark", the situation is much more restrictive for loggers in young stands. Because of reduced time to mark timber, DxP also facilitates the ability to strategically package sales at a faster pace.

The Ouachita National Forest uses DxP because it is a more efficient method when prescriptions are relatively simple and have less than three selection criteria. Based on my experience, including what I have learned from purchasers and DxP training sessions attended by purchasers, DxP allows purchasers to realize efficiencies through harvest planning in advance that considers access and logging corridors and landing areas. DxP techniques result in more stand density variability with less uniform spacing and higher quality residual trees when compared to a typically marked stand. In the South, forest industry has 30 or more years of experience using methods like DxP and commonly used the designation method to thin pine plantations to a specified residual basal area without any tree marking.

My discussions with purchasers and the bids received for DxP sales indicate purchasers are very receptive to using DxP. The results that purchasers have achieved, which I have seen, are exceptional. DxP can result in better residual stands and less logging damage than stands marked with paint. DxP timber sales in Region 8 are attractive to purchasers, garner more bids, and generate higher bid premiums because the purchaser can be more efficient than in marked sales. This also results in fewer no-bid sales.

Efficiencies gained in using DxP during the presale phases of a sale may increase sale administration due to more complex timber sale administration phases. DxP sales, however, are always scaled sales so there is no need to tally additional timber for activities such as equipment access, damaged timber review, landings, and temporary roads. The purchaser has the freedom to plan the harvest without additional Forest Service personnel marking additional trees thus obtaining the desired outcome in an efficient manner. The only extra work in using DxP is that the quality of prescription implementation must be done as a part of Sale Administration by checking the quality of trees left and the residual basal area. This results in more time being spent in a DxP sale by the sale administrator and possibly more frequent visits than in stands marked by Forest Service personnel.

DxP is not the best choice in some areas. Complicated prescriptions can cause problems for both the Forest Service and the purchaser. For instance, if the prescription stated that all shortleaf pine trees must be retained as leave trees in a stand mixed with shortleaf and loblolly pines, DxP may not work well since it is difficult to differentiate shortleaf pine from loblolly pine easily while operating a feller-buncher. Also, to be efficient in young pine plantations, the purchaser must have high production rates. A complicated prescription would take away the efficiency and may not even be implementable. Selection criteria needs to be fairly straight forward for it to be efficient for the cutting machine operator. If it is not efficient for both the operator and the Forest Service, it is not going to work. Paint can be used in a DxP prescription to identify locations of leave islands and openings, for trees of particularly high value or for trees that are difficult for the cutting machine operator to identify. The prescription must be clear and operationally feasible for the loggers so that they can make correct tree selections efficiently. That creates a win-win scenario for both parties.

Region 3—Jim Youtz

All Forests in Region 3 have either recently revised forest plans or are in the process of finalizing revisions. In Region 3, regionally desired conditions are described by forest type. For frequent fire forests of ponderosa pine, and dry mixed conifers, uneven-age management is emphasized consistent with the natural fire regime and desired objectives. The design understanding needed by practitioners is that DxP should be used only for simple prescriptions for low value material not requiring some level of precision in tree selection. The Region has some experience, however, in using DxP with certain uneven-age management prescriptions, like group selection cutting. With group selection, variable density and free thinning in the matrix is used, while the regeneration groups are generally designated with paint or flagging. This type of prescription is amenable for DxP.

Another new approach currently being used by the Region is the digital prescription guide. Silviculturists use tablet computers with geo-referenced aerial photos to digitally designate areas for treatment within a stand. For example, areas for group selection, including skips and gaps, are designated on the tablet. Technically they are writing a prescription on the tablet as they walk the stand. The digitally mapped prescription then is sent to the contractor as a shapefile to be used with a tablet in the cab of the harvesting equipment. This shapefile gives the exact location where the group openings, skips, and gaps should be. Early implementation shows good results. Digital prescription guides reduce a complex prescription to an operationally simple approach.

Forest Service foresters are much more willing to try this approach when they have large ongoing landscape scale projects, especially those done with stewardship contracts, because they can develop and issue one task order at a time. Often the contract implementation is started with a task order that uses leave tree timber marking. Once that task order is implemented by the contractor, it provides a demonstration template, representing a specific treatment prescription. The demonstration provides a good reference of the desired prescription to be implemented on DxP task orders with similar prescriptions. Forest Service foresters are hesitant to try DxP timber designation on small project areas where the contractor is unknown because there is no time to work intensely with the purchaser or contractor to ensure that the contractor has the ability, knowledge, and expertise necessary to meet the prescription, with an appropriate level of oversight by Forest Service administrators. DxP has not been tried out yet in single tree selection stands. This may be tried in the future, but that would depend on having an experienced operator with an established working relationship.

The big lesson learned from the Region's experience is that silviculturists need to work with the sale administrators to ensure that both are on the same page and the result is as expected. Another lesson learned is the operators' concern with some inefficiency. Operators indicated DxP slowed their operations because the free-thinning in the matrix required examining trees' canopies and making judgment calls. They felt confident about making those calls, but it slowed down productivity. This parameter might get more efficient over time with experience or might stay as an inherent issue of using DxP timber designation in uneven-aged silvicultural applications.

To sum up, DxP is still an ongoing learning process. It can be implemented in complex situations under some circumstances but doesn't work with all contractors and all prescriptions, especially where complex conditions such as dwarf mistletoe and other disease situations require more careful and time-consuming tree selection processes. Some purchasers do not like this process and the responsibility for making those decisions, so they do not bid on timber sales utilizing them. Many purchasers, however, are willing to bid on sales with DxP contract provisions.

Bell Lumber and Pole Company—Jim Parma

Bell Lumber and Pole Company (BLP) has been emphasizing DxP for the last 10 years, and it is good to see it is being used in proper stands and proper prescriptions. BLP is a 110-year-old family owned company and the largest producer of utility poles in North America. BLP has experience with thinning pine not only in the Lake States but also in the South, in Region 8, and some experience with Douglas fir and western red cedar in the West. The first thinning of pine stands is a good time to use DxP, but it also can be used in more than just that. Using DxP is about trust and partnership. The trust only can be gained from the experience of implementing the prescription on the ground. Experience and confidence will show DxP can be tried out on other than first thinning sites, such as basal area thinning or matrix free thinning.

In industry, DxP can help reduce costs. When DxP is implemented, a logger can get equipment to the trees that need to be cut without damaging or cutting the leave trees. In a typical timber sale, the purchaser must contact FS and they must mark any trees that are in the way and approve it. With DxP, the logger can simply cut appropriate trees and designate other leave trees without wasting time. That helps improve efficiency.

Industry people are looking at what trees to leave with the perspective of what trees will make a better product, as well as being interested in the long-term sustainability of forest resources.

Region 6, Siuslaw National Forest—Guenther Castillon

Using DxP can leverage and improve the silvicultural process in the Forest Service. Almost all timber sales in the Siuslaw National Forest are done by DxP. Some of the myths and challenges about DxP are discussed here.

Myths

One of the myths about DxP is that it only works on simple, less complex prescriptions. There are many complex interactions going on in the forests, but the only three things manipulated with prescriptions, generally, are density, species, and structure. Manipulating these characteristics can be simple and clear enough for the loggers, but communicating how to accomplish DxP contract provisions tend to be presented as complicated. Silviculturists, as well as the interdisciplinary team that may have developed the design criteria, should consider that it is not possible to meet all aspects of desired composition and structure. They

should be aware of what can be done and what nature has to offer and adapt the prescriptions accordingly. Nature is inherently variable, so if a single prescription is done across the whole unit, it does not mean the result will be uniform across the whole unit. Why not use natural variability rather than create it? There is no such thing as a perfect treatment.

If the treatment is too complex for the purchaser, it is too complex for the cruiser as well. If the prescription is seen as too complex, it implies a problem with the prescription. In DxP, there should be a clear purpose and objectives that are implementable and verifiable. The complexity can be removed by the way of sale layout and by marking the critically important trees. Clear thinking and clear communication can remove most of the complexity through understanding of the objectives and expectations across time and the landscape. Differentiation should be done between what should be achieved by removing certain trees and the associated decision points in selecting those trees. In most cases, there are no complexity issues.

The other myth of DxP is about accountability, i.e., that it cannot be assured using DxP. Accountability cannot always be assured with tree marking either: Paint on trees doesn't always guarantee accountability, although it can increase accountability. Accountability can be reached by clear agreements and clear expectations and communication and supporting each other with the common goal. The purchaser needs wood, the forester needs treatments—helping each other will benefit both by holding each other accountable through sale administration. In the end, DxP can be objectively verifiable if it is thoughtfully designed, written, and communicated through appropriate contract provisions.

Sale layout with DxP is cheaper when compared with tree marking. This creates another myth that it will solve fiscal and efficiency challenges for Forest Service management. Poor understanding of what the actual cost and time savings are and the reality of implementing DxP can worsen the situation and can lead to poor decisionmaking. Appropriate sale layout, cruising, and sale administration are still needed. Costs can be reduced because tree marking is not needed. With DxP, more costs may occur through more field visits at the right time (during and after the implementation, not before).

Challenges

Silviculturists should not put all the prescription development information into the final DxP document presented. It is not the place. That document should be clear and concise with decision points for selecting trees, and it should be presented in clear understandable language. "Simple" language doesn't mean ending up with a "simple" prescription or missing opportunities. In application, the more complex silvicultural prescription is reduced to a marking guide/tree designation guide that is inserted into the timber sale special contract provision that should be more readily interpretable or understandable by both the sale administrator and purchaser.

Both timber sellers and timber purchasers need to invest time and energy in making the process successful by establishing a relationship (which should be done regardless of the designation method). Silviculturists need to improve on clear thinking and clear communication: Consider the landscape perspective by not trying to achieve everything at one time. Silviculturists need to be more realistic with stand-level tactical implementation and gain a greater understanding of other resource disciplines.

Once identified challenges are addressed, the Forest Service can realize the true benefits of DxP in cost efficiencies through better trained, more versatile employees, more fulfilling work process with greater learning potential, clearer thinking, simpler silvicultural process, useful monitoring data, and more adaptive and efficient planning process.

SUMMARY

Using DxP on Forest Service timber sales has been an important business change for the agency. All panelists agree that DxP works best when prescriptions are well designed and communicated, and generally, when prescriptions are not too complex and are limited to about three selection criteria. Forest Service personnel using DxP need to focus on the residual stand and not as much on the individual trees being removed, i.e., concentrate on the overall density, species, and structure of the resulting stand, and not so much on individual trees being left in the exact correct spot. Techniques are available, however, to handle more complex prescriptions (DxP with Reserve Tree Marking, and digital prescription guide). If there are individual trees that are specifically important for biodiversity or other reasons, Forest Service personnel can mark them as reserve trees. Also, digital prescription guides may be used for complex prescriptions, where a tablet is used in the cab of the logging equipment to assist in what type of harvesting should occur in each area.

DxP does not work with all contractors and all prescriptions. Complex conditions such as dwarf mistletoe, other disease situations, and salvage logging after a fire (where live crown ratios are considered) require more careful and time-consuming tree selection processes. Prescriptions that utilize characteristics of individual trees rather than stand characteristics may be more suitable for individual tree marking. Additionally, prescriptions that depend on individual tree characteristics may be more difficult to implement and administer.

DxP can reduce sale layout costs because tree marking is not needed. With DxP, however, sale administration may increase through more field visits during and after implementation, and operator costs may increase if tree selection decisions increase harvesting time. Additionally, the assurance of meeting desired conditions may be lessened when paint is not used. Foresters may be hesitant to try DxP timber designation on small project areas and when the contractor's expertise and performance history is unknown. Development of a good working relationship is important.

DxP can help timber sale purchasers and stewardship contractors achieve better efficiency in harvesting and thinning operations because the operators don't have to give the Forest Service notification around factors specific to the silvicultural prescription and their operator-specific considerations such as cutting trees for skid trails and landings. Trees are not individually designated for cutting or leaving. Operators are free to make any adjustments they want as long as they meet the prescription criteria.

A DxP prescription must be written clearly and must include specific desired end results that are measurable and understandable by both Forest Service sale administration personnel and timber sale purchasers or stewardship contractors. Silviculturists should ensure prescriptions are clear, well-communicated, and tailored to the appropriate desired end result for the landscape to be harvested. Silviculturists need to consider operational feasibility and stand-level tactical implementation when developing silviculture prescriptions.

Use of DxP continues to be an ongoing learning process. Using DxP is about trust and partnership. The trust only can be gained from the experience of implementing the prescription on the ground. Experience and confidence will show that DxP can be implemented on a variety of stand conditions and sites.

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